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Request for grant of a patent

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1. Your reference	RFW/ND/CB60561P
2. Patent application number *(The Patent Office will fill this part in)*	22 OCT 2003 0324658.4
3. Full name, address and postcode of the or of each applicant *(underline all surnames)*	GlaxoSmithKline Consumer Healthcare GmbH & Co. KG. Bussmatten 1, D - 77815 Buehl (Baden) Germany
Patents ADP number *(if you know it)*	8304701001
If the applicant is a corporate body, give the country/state of its incorporation	German
4. Title of the invention	Novel Process
5. Name of your agent *(if you have one)*	Corporate Intellectual Property
"Address for service" in the United Kingdom to which all correspondence should be sent *(including the postcode)*	GLAXOSMITHKLINE CORPORATE INTELLECTUAL PROPERTY (CN9 25.1) 980 GREAT WEST ROAD BRENTFORD MIDDLESEX TW8 9GS
Patents ADP number *(if you know it)*	8072555004

6. Priority: Complete this section if you are declaring priority from one or more earlier patent applications, filed in the last 12 months.

Country	Priority application number *(if you know it)*	Date of filing *(day / month / year)*

7. Divisionals, etc: Complete this section only if this application is a divisional application or resulted from an entitlement dispute (see note f)

Number of earlier UK application	Date of filing *(day / month / year)*

8. Is a Patents Form 7/77 (Statement of inventorship and of right to grant of a patent) required in support of this request?

Answer YES if:

a) any applicant named in part 3 is not an inventor, or
b) there is an inventor who is not named as an applicant, or
c) any named applicant is a corporate body.

Otherwise answer NO (See note d)

9. Accompanying documents: A patent application must include a description of the invention. Not counting duplicates, please enter the number of pages of each item accompanying this form:

Continuation sheets of this form	
Description	12
Claim(s)	4
Abstract	
Drawing(s)	4

10. If you are also filing any of the following, state how many against each item.

Priority documents	
Translations of priority documents	
Statement of inventorship and right to grant of a patent (Patents Form 7/77)	
Request for a preliminary examination and search (Patents Form 9/77)	1
Request for a substantive examination (Patents Form 10/77)	
Any other documents (please specify)	

11. I/We request the grant of a patent on the basis of this application.

Signature(s) R. F. Walker Date 22 October 2003

12. Name, daytime telephone number and e-mail address, if any, of person to contact in the United Kingdom

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Novel Process.

This invention relates to processes for making toothbrushes.

Toothbrushes are well known articles and generally comprise a head from which bristles extend in a bristle direction, the head being connected to (or connectable to in a replaceable head toothbrush) a grip handle. Generally there is a thinned neck region longitudinally between the head and handle. The head and handle are disposed along a toothbrush longitudinal direction.

A particular type of toothbrush has a head which comprises at least two, typically three, sections which carry bristles and are disposed widthways adjacent on opposite sides of a toothbrush longitudinal direction, each section comprising a neck which flexibly links the section to the grip handle, and is integrally made with the brush handle. Toothbrushes of this general type are disclosed for example in US-D-440,404, US-A-4,864,676, US-A-4,472,853, US-A-1,323,042, FR-A-1,247,433, FR-A-2,548,528 and WO-A-98/02062.

Toothbrushes are almost always made by an injection moulding process in which hot fluid plastic material is injected under pressure into a mould cavity which is accurately internally shaped to define the corresponding shape of the toothbrush formed in the mould.

There is consequently a problem when such a mould is used to make the particular type of toothbrush described above in which the sections are to be close together widthways typically in sliding contact with each other. The gap between the sections is defined by a dividing wall in the mould between the parts of the cavity in which the adjacent sections are to be moulded. If the desired spacing between the sections is small the dividing wall between these parts of the mould is relatively thin e.g. less than 0.5 mm and can consequently distort or break under the pressures experienced during injection moulding.

WO-A-00/76370 discloses a toothbrush of this type in which both the head and handle are made in two longitudinally split halves which are then connected together at the handle so that the head remains in the form of two independently flexible moveable sections. This process disadvantageously requires a mould cavity to make each half of the toothbrush, adding to initial mould costs or reducing the capacity of production.

It is an objective of this invention to provide a process by which toothbrushes of the particular type described above may be made with a small space between sections without risk of distortion of the mould during injection of the plastic material into the injection mould.

According to this invention a process for making a toothbrush head of the type comprising at least two sections widthways adjacent to each other on opposite sides of a toothbrush longitudinal direction, the sections being flexibly integrally linked to each other is provided, the process comprising the stages:

firstly making the head in an injection moulding process with the sections flexibly integrally linked to each other and relatively spaced further apart from each other in a widthways direction,

secondly moving the sections of the so formed head relatively closer to each other in a widthways direction.

Preferably the process is one in which the sections comprise a head part adapted to carry bristles, e.g. provided with bristle holes into which bristle tufts may subsequently be fixed, and a neck part via which the head part is integrally linked to the toothbrush handle and consequently to another section. Such a neck part may be flexible, and/or the link between the neck part and the head part of the section, or between the neck part and the handle may be flexible. The flexible linking is preferably resiliently, i.e. springy, flexible linking as may be achieved by integral construction with the types of plastics materials commonly used for toothbrushes.

When the sections are moved relatively closer together in the process a distortion of the integral link may occur at the junction between the head part of the section and the neck part, at the junction between the neck part and the handle, or at any other position of the neck part.

In the first stage of the process the sections may be spaced apart with their respective longitudinal directions diverging with increasing longitudinal distance of the section from the handle, i.e. splaying progressively with this longitudinal distance, so that the longitudinal directions of the sections diverge in the direction away from the handle with a non zero angle relative to the toothbrush longitudinal direction, for example 1 to 45°, e.g. 1 to 5°. Then in the second stage of the

process the sections may be moved relatively closer to each other in a widthways direction so that as a result the angle of divergence lessens.

The sections may be spaced apart in a widthways direction perpendicular to the bristle direction, i.e. the direction in which the bristles are to be aligned when fitted into the head part.

Additionally or alternately the sections may be spaced apart in a direction parallel to the bristle direction.

Additionally or alternatively the longitudinal directions of three or more sections may be spaced apart so that they diverge about a solid angle, e.g. to lie on the surface of a constructed cone or pyramid.

When sections comprise a neck part by which they are integrally linked to the handle the neck parts also may be made relatively spaced apart in a widthways direction and the neck parts may also then be moved relatively closer together.

When such a toothbrush head is made by an injection moulding process from hot plastics material some shrinkage of the formed head is likely to occur as the head cools after removal from the mould, which may move the sections closer together but this shrinkage is likely to be relatively small.

Suitably with the sections in their relatively closer to each other configuration the sections of the toothbrush head may be in a position corresponding to their position for use in the final product toothbrush.

The process of the invention enables toothbrush heads to be made in which after the sections are moved closer together they are separated by a widthways gap of less than 0.5mm preferably less than 0.2mm, preferably so that they are in sliding contact with each other. When the sections are spaced relatively far apart their furthest spaced apart parts are spaced further apart than these distances, e.g. 0.5mm or more apart.

Preferably the toothbrush head is made of a thermoplastic material and the sections are moved closer together with the material in a hot malleable state. Suitable plastics materials of which the toothbrush head and handle may be made include polypropylene, polyamides etc., which may for example be fibre-reinforced e.g. polyester fibre reinforced, to modify flexibility are well known in the toothbrush art. Suitable softening temperatures for these types of materials are

known in the art. Injection moulding processes normally involve injection of a plastic material in a hot fluid state under pressure into the mould cavity, followed by opening the mould and ejecting the moulded product, e.g. using ejector pins, when it has cooled sufficiently to be robust, but may still be hot. The material may therefore be provided in such a hot malleable state by performing the moving of the sections closer together shortly after the head has been removed from the mould so that the material is still in a hot malleable state after the injection moulding stage. Alternatively the head may be heated to render the material malleable, e.g. with a jet of hot gas, microwave heating or heat or radiation (e.g. laser) radiation directed at the head. Suitably such heating is localised to one or more specific area of the toothbrush, for example the junction between a neck part and the handle.

After the sections have been moved closer together they may be fixed in this closer together relationship. For example if the sections are moved closer together with the material in a hot malleable state the sections may be fixed in this relationship by cooling the material or allowing the material to cool after the sections have been moved closer together so that the material sets rigid.

Additionally or alternatively the sections may be fixed by injecting a second fluid plastic material around and/or between a part of the sections, in particular a region of a flexible neck part particularly a region adjacent to the grip handle, and causing or allowing this second fluid material to set to thereby hold the sections in their closer together relationship. Such a second plastic material may be a hard plastics material such as polypropylene or polyamide etc., or may be a thermoplastic elastomer (TPE) material such as the known Evoprene™ or Santoprene™ materials. Such materials are known which can bond to the plastics materials of which toothbrushes are made.

In such an embodiment of the process a plastic material part of the toothbrush, e.g. comprising the handle and the sections, may be first made by an injection moulding process in the form of a plastics material "skeleton", suitably with one or more cavity in its structure defining the shape and position of an intended second material part, and then after the sections have been moved into their closer together relationship the second material may be injected into this cavity. The general procedure of making two-material toothbrushes by first making a plastics

material "skeleton" and then enclosing the skeleton in a mould cavity and injecting in the second material is well known in the toothbrush art.

Additionally or alternatively the sections may be fixed into their closer together relationship by a weld, such as an adhesive, thermal or ultrasonic weld between adjacent sections, e.g. between adjacent flexible neck parts.

Additionally or alternatively adjacent sections may be provided with mechanical locking features, e.g. interlocking parts, which engage when the sections are moved into their closer together relationship.

Bristles may be inserted into the toothbrush head of the present invention using generally conventional processes. For example the head part may be made in the injection moulding process provided with holes for the insertion of bristle tufts, and bristle tufts may be then fixed into these holes. Alternatively for example bristles may project into the mould cavity in which the head part is formed, so that the bristles become set in the solidified head material.

The invention also provides a toothbrush head and a toothbrush as a product when made by such a process.

Such a toothbrush head comprises at least two sections widthways adjacent to each other on opposite sides of a toothbrush longitudinal direction, the sections being flexibly integrally linked to each other at their ends closest to the grip handle wherein the sections of the so formed head are relatively close to each other in a widthways direction.

Preferably the sections comprise a head part adapted to carry bristles, and a neck part via which the section is integrally linked to the toothbrush handle and consequently to another section. Such a neck part may be flexible, and/or the link between the neck part and the head part of the section, or between the neck part and the handle may be flexible. The flexible linking is preferably resiliently, i.e. springy, flexible linking as may be achieved by integral construction with the types of plastics materials commonly used for toothbrushes.

Preferably in the completed toothbrush the sections relatively closer together they are separated by a widthways gap of less than 0.5mm preferably less than 0.2mm, preferably so that they are in sliding contact with each other.

The sections in this closer together relationship may be fixed in this relationship by means of a second fluid plastic material around and/or between a part of the sections, in particular a region of a flexible neck part particularly a region adjacent to the grip handle. Such a second plastic material may be a hard plastics material, or may be a thermoplastic elastomer (TPE) material as discussed above. Additionally or alternatively the sections may be fixed into their closer together relationship by a weld, such as an adhesive, thermal or ultrasonic weld between adjacent sections, e.g. between adjacent flexible neck parts. Additionally or alternatively adjacent sections may be provided with mechanical locking features, e.g. interlocking parts, which engage when the sections are moved into their closer together relationship.

The invention also provides an apparatus for performing the process of the invention, the apparatus comprising:

an injection moulding means adapted to make a toothbrush head of the type comprising at least two sections widthways adjacent on opposite sides of a toothbrush longitudinal direction, with the sections flexibly integrally linked to each other and relatively spaced apart in a widthways direction;

and means to move the sections of the so formed head relatively closer.

The invention also provides an apparatus adapted to be supplied with a toothbrush head of the type comprising at least two sections widthways adjacent on opposite sides of a toothbrush longitudinal direction, the sections being flexibly integrally linked to each other, with the sections flexibly integrally linked to each other and relatively spaced apart in a widthways direction, the apparatus being adapted to move the sections of the head relatively closer together.

In a preferred process and apparatus of this invention the apparatus adapted to be supplied with a toothbrush head comprises a "cassette", i.e. a holder for the toothbrush head and preferably the toothbrush handle also and within which the toothbrush head may be contained whilst the sections are moved into their closer together relationship, and which may also define a mould cavity into which a second fluid plastic material may be injected as described above. Such a cassette is used for supporting the pre-moulded skeleton, moving the sections closer together, and for injecting a second plastic material.

The invention will now be described by way of example only with reference to the accompanying drawings.

Fig. 1 shows a plan view of a skeleton of a toothbrush with its sections splayed apart.

Fig. 2 shows a plan view of the toothbrush of Fig. 1 after its sections have been moved closer together.

Fig. 3 shows the toothbrush of Fig. 2 after a second component material has been injected in.

Fig. 4 shows a plan view of part of an injection mould suitable for making the skeleton of Fig. 1.

Fig. 5 shows a side view of a skeleton of a toothbrush with its sections splayed apart.

Fig. 6 shows a plan view of the skeleton of Fig. 5.

Fig. 7 shows a side view of the toothbrush skeleton of Fig. 5 after its sections have been moved closer together.

Fig. 8 shows a cross section through part of an injection mould suitable for making the skeleton of Fig. 5.

Figs. 9-11 show the construction and operation of a "cassette".

Referring to Figs 1-3, as seen in Fig. 1 a skeleton of a toothbrush 10 (overall) comprises a handle 11 integrally formed with three sections 12, 13, 14 made using a generally conventional injection moulding process. Each section 12, 13, 15 comprises a respective head part 15, 16, 17 in which are formed bristle tuft holes 18 during the moulding process, using conventional bristle pins (not shown) projecting into the mould cavity to form holes 18. Each section 12, 13, 14 also comprises a respective resiliently flexible neck part 19, 20, 21 integral with the head part 15, 16, 17 and the handle 11. The skeleton 10 has a head-handle toothbrush longitudinal direction A-A. The view in Fig. 1 is a plan view looking down the bristle direction, i.e. the direction in which bristles will extend when they are fixed into the head part 15, 16, 17.

As seen in Fig. 1 the toothbrush 10 is shown as made in an injection moulding process with the sections 12, 13, 14 relatively spaced apart in a widthways direction, As shown the sections 12, 13, 14 are splayed apart so that the respective

longitudinal directions B-B of the outer sections 12, 14 diverge from the longitudinal direction of the middle section 13, with increasing longitudinal distance of the section 12, 14 from the handle 11, i.e. splaying progressively with this longitudinal distance, so that the longitudinal directions B-B of the sections 12, 14 and their flexible neck parts 19, 21 diverge in the direction away from the handle 11 with an angle ca. 10° to the longitudinal direction A-A.

It will be appreciated that in such a mould there need be no thin dividing wall between the respective mould cavities in which the sections 12, 13, 14 are formed by injection moulding. At their closest together point, where the sections 12, 13, 14 meet the handle 11 the gaps 22 between the neck parts 19, 20, 21 may be 0.5mm or more. As shown in Fig. 1 the three sections 12, 13, 14 all lie substantially in a plane perpendicular to the bristle direction.

As seen in Fig. 2 the toothbrush 10 with its sections 12, 13, 14 has been removed from the injection mould (see Fig. 4) in which it was formed, and the sections 12, 13, 14 and their respective neck parts 19, 20, 21 have been moved relatively closer together. This has been achieved by applying pressure to the outermost sections 12 and 14 to cause them to swing inwardly by distortion at the integral junction between the neck parts 19, 21 and the toothbrush handle 11, the gap between the sections 12, 13, 14 is shown exaggerated for clarity.

This pressure may be applied by suitable contact parts (not shown) e.g. inward pressing jaws, pistons, or other inwardly moveable parts applying inward pressure to the neck parts 19, 21. During this operation the toothbrush skeleton 10 may be held in a second mould cavity (not shown) into which the skeleton 10 fits, and which incorporates the inwardly moveable parts. The outer surface of the skeleton includes a cavity 23 which is to contain and define the shape of the subsequently to be injected second plastic material.

As shown in Fig. 3 a second material being a thermoplastic elastomer material 40 has been injected into the cavity 23 in the skeleton 10. The second material 40 has also flowed a short longitudinal distance into the gaps 22 between neck parts 19, 20, 21 under known injection conditions such that the plastics material of the skeleton 10, including the neck parts 19, 20, 21 bonds with the elastomer material 40.

As will be seen in connection with Figs. 9, 10 and 11 the injection of the second material 40 may be achieved with the handle part 11 and the immediately longitudinally adjacent part of neck parts 19, 20, 21 of the skeleton 10 contained within a second mould cavity which incorporates bulkheads which fit into the gaps 22 and define the extent to which the material 40 can flow longitudinally along the gaps 22. The elastomer material 40 is injected into the second mould cavity in a hot fluid state and subsequently sets to thereby hold the neck parts 19, 20, 21 in their closer together state.

In a modification of this process inward pressure may be applied to the outer neck parts 19, 21 whilst they, or the integral junction between the neck parts 19, 21 and the toothbrush handle 11, are hot and plastically malleable so that as they subsequently cool they remain in the closer together relationship of Fig. 2. For this modification the neck parts 19, 21 or the integral junction with the handle 11 may be locally heated e.g. with a jet of hot air.

Referring to Fig. 4 a plan sectional view of part 40 of an injection mould is shown. This is made conventionally of precision steel using a conventional spark erosion process. The mould 40 includes a mould cavity 41 corresponding to the shape of skeleton 10 of Fig. 1. In the parts of the cavity 41 corresponding to the head parts 15, 16, 17 bristle pins 42 extend to form the bristle holes 18. There is a conventional injection port 43 through which hot fluid plastics material may be injected under pressure. The mould 40 incorporates other conventional features of a toothbrush skeleton injection mould, e.g. ejector pins (not shown).

Referring to Figs. 5, 6 and 7, Fig. 5 shows the plastics material skeleton of a toothbrush 10 in a sideways view looking perpendicular to the bristle direction , i.e. the direction designated by an arrow in which bristles (not shown) will be aligned when bristles are fixed into the head parts 15, 16, 17. As seen in Fig. 5 the toothbrush 10 is shown as made in an injection moulding process with the middle section 13 spaced apart in a widthways direction parallel to the bristle direction from the two outer sections 12, 14. As shown in Fig. 5 the sections 12, 13, 14 are splayed apart so that the respective longitudinal directions B-B of the sections 12, 13, 14 diverge with increasing longitudinal distance of the section 12, 13, 14 from the handle 11, i.e. splaying progressively with this longitudinal distance, so that the

longitudinal directions B-B of the sections 12, 13, 14 and their flexible neck parts 19, 20, 21 diverge in the direction away from the handle 11 with an angle ca. 15° to the longitudinal direction. Fig. 6 shows the same skeleton in a plan view.

As seen in Fig. 5 the outer sections 12, 14 are substantially in a plane perpendicular to the bristle direction, and the middle section 13 is displaced above this plane. The sections 12, 13, 14 are consequently seen to be splayed by a solid angle, i.e. with their longitudinal directions lying on the surface of a pyramid.

As seen in the side view of Fig. 7 the toothbrush skeleton 10 with its sections 12, 13, 14 has been removed from the injection mould 70 in which it was formed, and the sections 12, 13, 14 have been moved relatively closer together, i.e. into a relationship corresponding to Fig. 2. This has been achieved by applying pressure to the middle neck part 13 downwardly causing distortion to the integral junction between the neck part 13 and the handle 11 such that the middle section 13 moves closer in the widthways direction e.g. in the bristle direction to the outer sections 12, 14. Simultaneously if necessary inward pressure may be applied to the outer neck parts 19, 21 to move the outer sections 12, 14 closer to the middle section 13.

This pressure may be applied by a suitable downwardly moveable pressure part (not shown) applied to the middle section 13. Analogously with Fig. 2 during this operation the toothbrush 10 may be held by a cassette which incorporates the downwardly moveable pressure part.

Analogously to Fig. 3 a second material 40 being a thermoplastic elastomer material may be injected into the cavity 23 in the handle 11 and allowed to flow into gaps 22 between the neck parts 19, 20, 21 under known injection conditions such that the plastics material of the neck parts 19, 20, 21 bonds with the elastomer material 20. The elastomer material 40 injected into the gaps 22 in a hot fluid state subsequently sets to thereby hold the neck parts 19, 20, 21 and consequently sections 12, 13, 14 in their closer together state. In a modification of this process inward pressure may be applied to the middle neck part 20 whilst it, or the place where it meets the handle 11, is hot and plastically malleable so that as it subsequently cools it remains in the closer together relationship.

Fig. 8 shows a cross section through part of the injection mould 80 in which the toothbrush skeleton 10 of Fig. 4 is made showing the arrangement of the mould

cavities 81, 82, 83 in which the respective sections 12, 13, 14 are moulded. The mould 80 comprises two part-moulds 84, 85 which are split in a conventional manner at split line 86. Fig. 8 shows the relative separation of the sections 12, 13, 14 at the line C-C, i.e. as cut through the neck parts 19, 20, 21. The injection mould 80 used to make the skeleton 10 may be otherwise conventional in the toothbrush field. It will be appreciated, as seen in Fig. 8 that in such a mould there need be no thin dividing wall between the respective mould cavities 81, 82, 83 in which the sections 12, 13, 14 are formed by injection moulding.

After manufacture using the above-described process bristles may be fixed into the holes 18 using a conventional bristling machine as known in the art. Alternatively bristles may be made set in the head parts 15, 16, 17 using the so-called "anchorless" process in which ends of bristle tufts project into the mould cavity and the plastic material injected in to surround and embed the bristle tufts.

Figs. 9, 10 and 11 show a "cassette" 90 in which a skeleton 10 as shown in Fig. 1 may be held. The cassette 90 includes a second mould cavity 91 seen in plan view in Fig. 9 in which the handle part 11 of the skeleton 10 sits and is enclosed between cassette 90 and an upper (as seen) cassette part (not shown) and which closely contains the handle part 11 so that thermoplastic elastomer material may be subsequently injected in to form a grip pad 40. The enclosing of a toothbrush handle in a mould cavity formed by upper and lower mould parts and formation of an elastomer grip pad 40 in this way is conventional in the toothbrush art. The sections 12, 13, 14 project beyond the part of the cassette which contains this cavity 91, into an area 92. Adjacent to area 92 are pistons 93 arranged in the sides of area 92 able to move inwardly to apply inward pressure to the neck parts 19, 21.

As is shown in Fig. 9 the pistons 93 have moved inwardly. Situated in area 92 are bulkhead parts 94 which extend upwardly integrally from the lower surface (not shown) of the area 92 and which fit between the middle neck part 20 and the outer neck parts 19, 21 when the skeleton 10 is inserted into cavity 91. As the neck parts 19, 21 move inwardly under the pressure of pistons 94 they abut against the bulkhead parts 94 so that the gaps 22 enclosed between the neck parts 19, 20, 21 and the bulkhead parts 94, and the upper and lower surfaces of the area 92 adjacent to the neck parts 19, 20, 21 and the bulkhead parts 94 become fluid-tight against the

injection of fluid thermoplastic elastomer into the cavity 23 of handle 11 via an injection port (not shown) of generally conventional design feeding into cavity 23.

Fig. 10 shows the situation when the elastomer material 40 has been injected into cavity 23 and has flowed longitudinally along gaps 22 as far as is allowed by bulkheads 94, and has solidified to produce the toothbrush as shown in Fig. 3. the pistons 93 may be withdrawn outwardly to the position shown in Fig. 9, the upper and lower parts of cassette 90 separated and the completed toothbrush 10 removed from cassette 90 for a subsequent bristling operation.

Claims:

1. A process for making a toothbrush head of the type comprising at least two sections widthways adjacent to each other on opposite sides of a toothbrush longitudinal direction, the sections being flexibly integrally linked to each other, the process comprising the stages:

firstly making the head in an injection moulding process with the sections flexibly integrally linked to each other and relatively spaced apart from each other in a widthways direction,

secondly moving the sections of the so formed head relatively closer to each other in a widthways direction.

2. A process according to claim 1 wherein the sections are made in the form of a head part adapted to carry bristles and a neck part via which the section is integrally linked to the toothbrush handle and consequently to each other.

3. A process according to claim 2 wherein when the sections are moved relatively closer together a distortion of the integral link occurs at the junction between the head part of the section and the neck part, at the junction between the neck part and the handle, or at any other position of the neck part.

4. A process according to any one of claims 1 to 3 wherein in the first stage of the process the sections are spaced apart with their respective longitudinal directions diverging with increasing longitudinal distance of the section from the handle and then in the second stage of the process the sections are moved relatively closer to each other in a widthways direction so that as a result their respective longitudinal directions are parallel.

5. A process according to any one of the preceding claims wherein the sections are spaced apart in a direction perpendicular to the bristle direction.

6. A process according to any one of the preceding claims wherein the sections are spaced apart in a direction parallel to the bristle direction.

7. A process according to any one of the preceding claims wherein the longitudinal directions of three or more sections are spaced apart so that they diverge about a solid angle.

8. A process according to any one of claims 2 to 7 wherein the neck parts are made relatively spaced apart from each other in a widthways direction and the neck parts are also then moved relatively closer together to each other.

9. A process according to any one of the preceding claims wherein after the sections are moved closer together they are separated by a widthways gap of less than 0.5mm.

10. A process according to claim 9 wherein after the sections are moved closer together they are in sliding contact with each other.

11. A process according to any one of the preceding claims wherein the toothbrush head is made of a thermoplastic material and the sections are moved closer together with the material in a hot malleable state.

12. A process according to claim 11 wherein the material is provided in such a hot malleable state by making the head from a hot fluid plastic material using an injection moulding process and performing the moving of sections closer together shortly after the head has been removed from the mould so that the material is still in a hot malleable state after the injection moulding stage.

13. A process according to any one of claims 1 to 11 wherein the material is provided in such a hot malleable state by heating the head to render the material malleable.

14. A process according to any one of the preceding claims wherein after the sections have been moved closer together they are fixed in this closer together relationship.

15. A process according to claim 14 wherein the sections are moved closer together with the material in a hot malleable state and the sections are fixed in this relationship by cooling the material or allowing the material to cool after the sections have been moved closer together.

16. A process according to claim 14 or 15 wherein the sections are fixed by injecting a second fluid plastic material around and/or between a part of the sections and causing or allowing this second fluid material to set to thereby hold the sections in their closer together relationship.

17. A process according to claim 16 wherein the sections are fixed by injecting a second fluid plastic material around and/or between a part of a flexible neck part and causing or allowing this second fluid material to set to thereby hold the sections in their closer together relationship.

18. A process according to claim 16 or 17 wherein the second plastic material is a plastics material.

19. A process according to claim 16 or 17 wherein the second plastic material is a thermoplastic elastomer material.

20. A process according to any one of claims 16 to 19 wherein a plastic material part of the toothbrush are first made by an injection moulding process in the form of a plastics material skeleton, with one or more cavity in its structure defining the shape and position of an intended second material part, and then after the sections have been moved into their closer together relationship the second material is injected into the cavity.

21. A process according to claim 14 wherein the sections are fixed into their closer together relationship by a weld between adjacent sections.

22. A process according to any one of claims 14 to 21 wherein adjacent sections are provided with mechanical locking features which engage when the sections are moved into their closer together relationship.

23. A toothbrush head as a product of a process according to any one of claims 1 to 22.

24. An apparatus for performing a process according to any one of claims 1 to 22 comprising:

an injection moulding means adapted to make a toothbrush head of the type comprising at least two sections widthways adjacent on opposite sides of a toothbrush longitudinal direction, with the sections flexibly integrally linked to each other and relatively spaced apart in a widthways direction;

and means to move the sections of the so formed head relatively closer.

25. An apparatus adapted to be supplied with a toothbrush head of the type comprising at least two sections widthways adjacent on opposite sides of a toothbrush longitudinal direction, the sections being flexibly integrally linked to each other, with the sections flexibly integrally linked to each other and relatively spaced apart in a widthways direction, the apparatus being adapted to move the sections of the head relatively closer together.

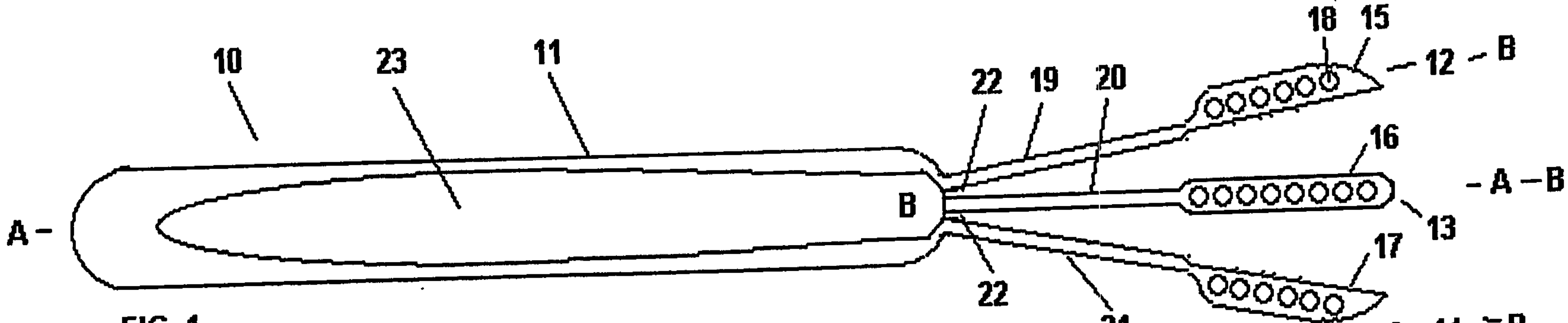


FIG. 1

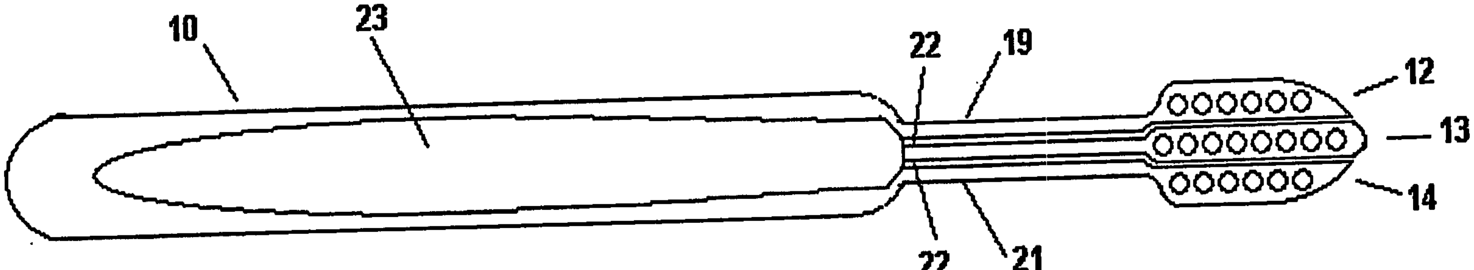


FIG.2

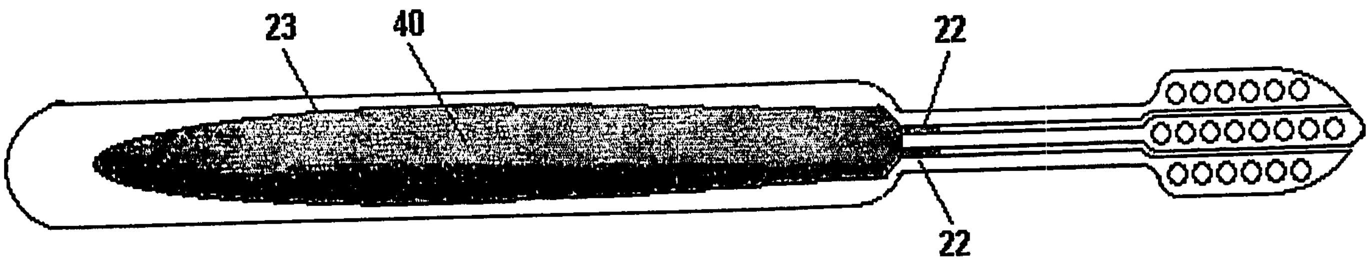


FIG.3

FIG.4

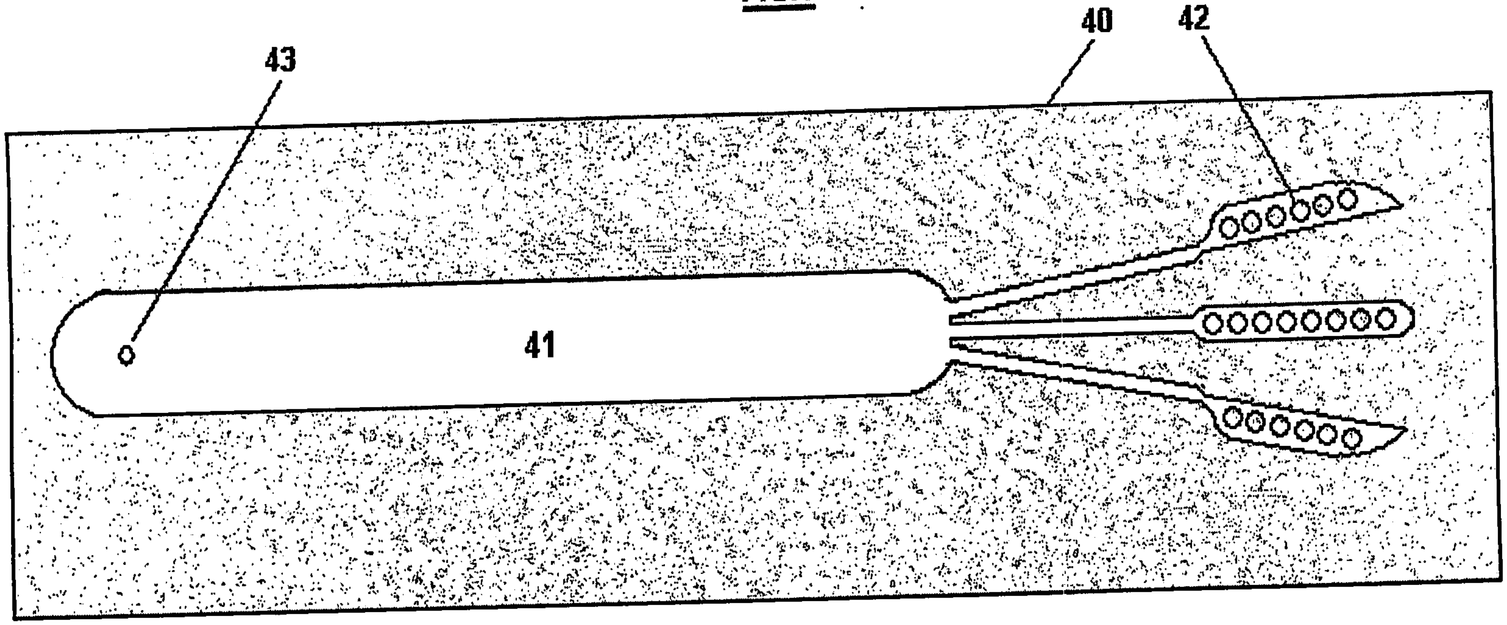


FIG. 8

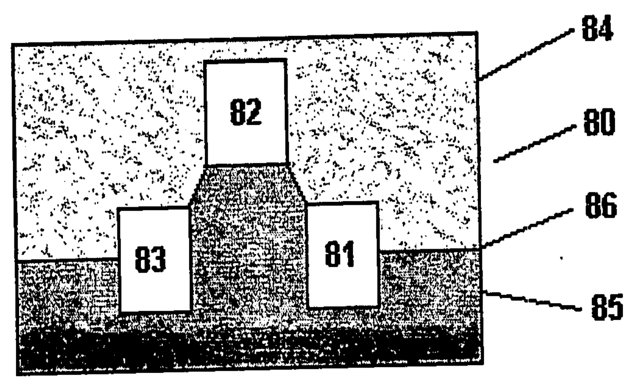


FIG.5

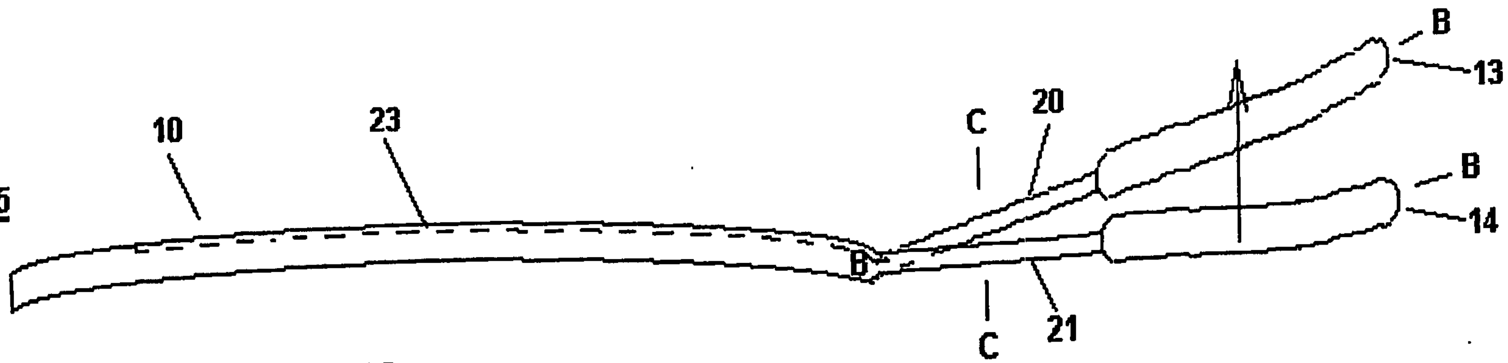


FIG. 6

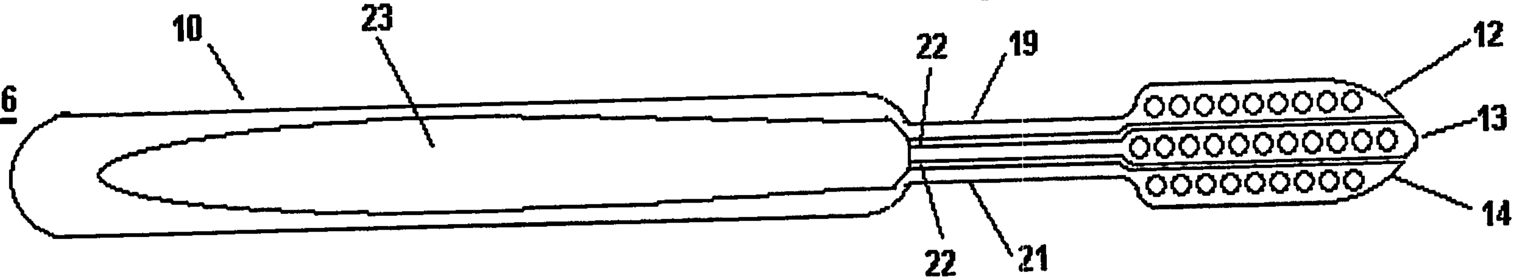
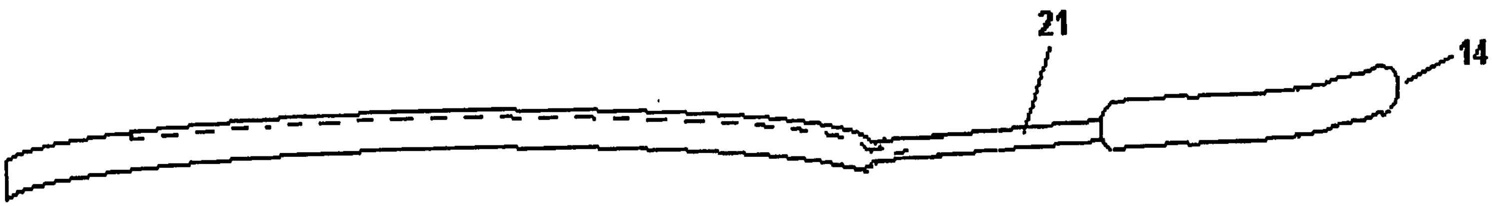


FIG.7



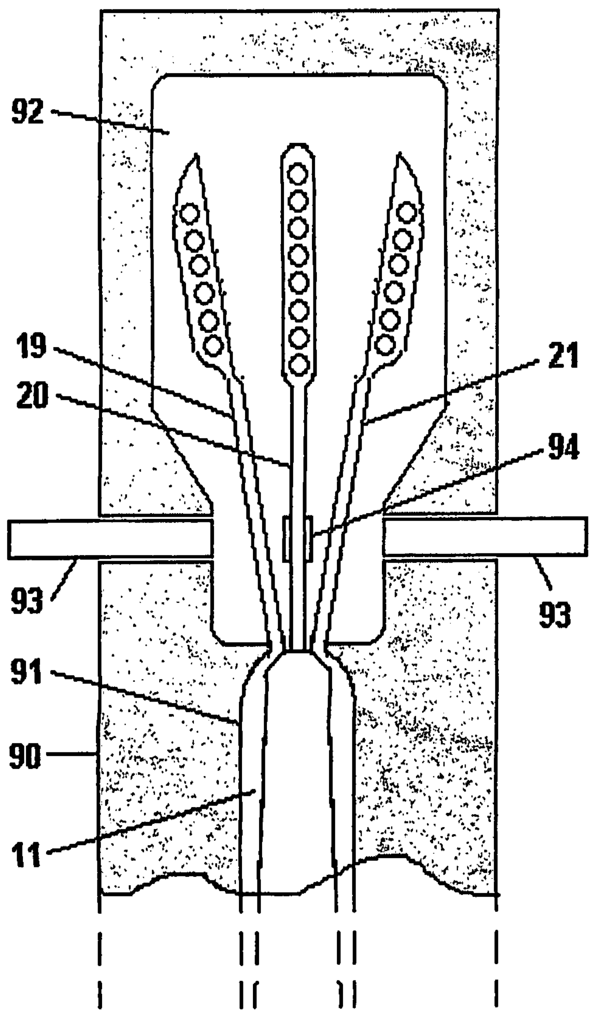


FIG. 9

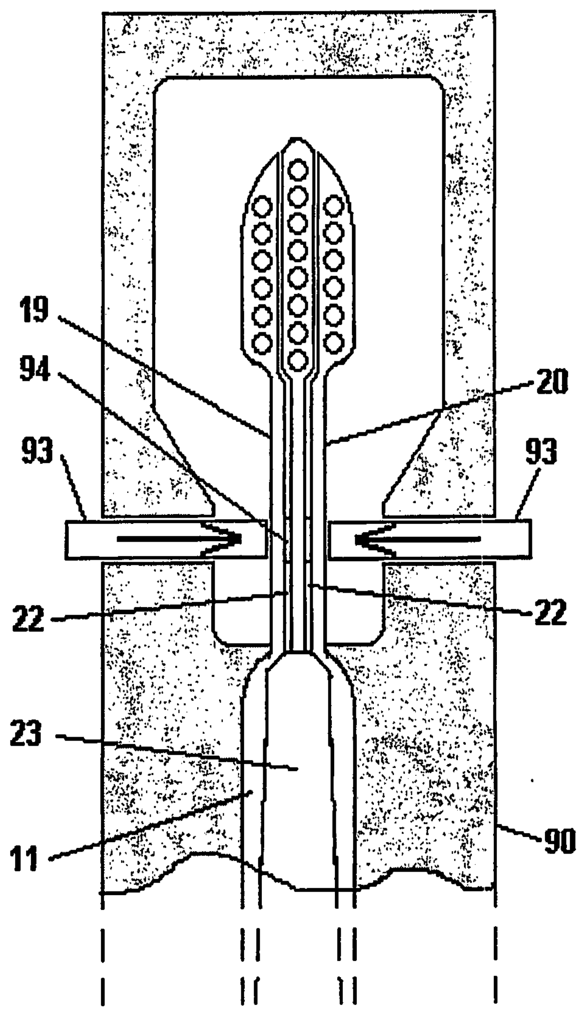


FIG.10

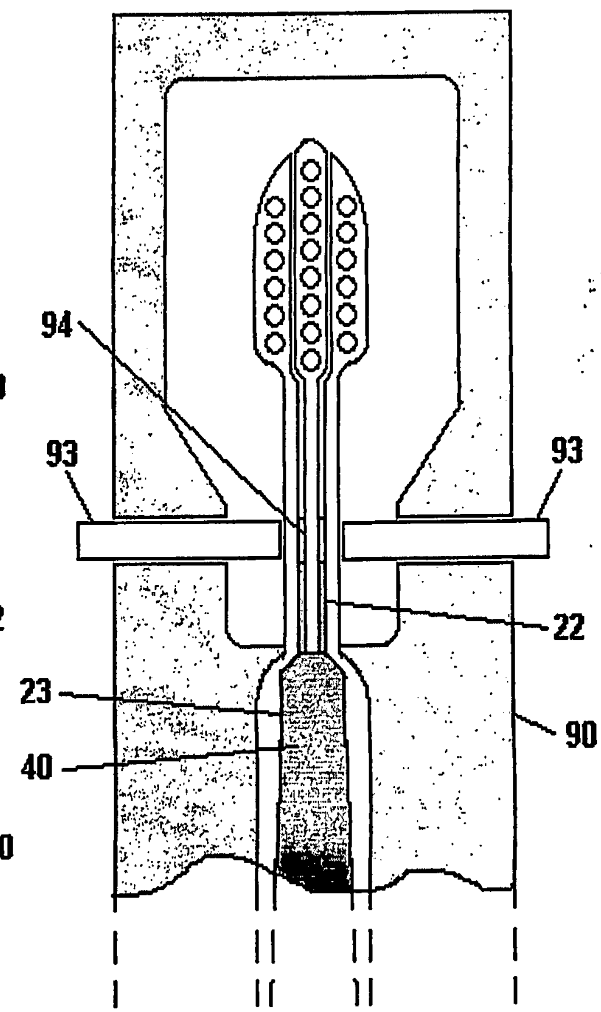


FIG.11